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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/055,201	04/03/1998	WILLIAM BROWN	933.P1/MXP/R	3603

7590 06/18/2002

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EXAMINER
ZERVIGON, RUDY

ART UNIT	PAPER NUMBER
1763	27

DATE MAILED: 06/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/055,201	Applicant(s) Brown, W., Herchen, H., Welch, M.D.
	Examiner First Last	Art Unit 1234

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Mar 20, 2002*.

2a) ☒ This action is **FINAL.** 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-11, 14, 15, 24, 26-73, and 75-78* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☒ Claim(s) *10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78* is/are allowed.

6) ☒ Claim(s) *1-6, 8, 9, 31, and 32* is/are rejected.

7) ☒ Claim(s) *7 and 37-39* is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☐ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 6, 9, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Specifically, Randall S. Mundt describes a process chamber (12; column 2, lines 64-68) for processing a substrate (column 2, lines 64-68; column 8, lines 40-45) in a process gas and reducing emissions of hazardous gas to the environment (abstract). Randall S. Mundt additionally describes the process chamber (column 8, lines 40-45) where for processing a substrate on a substrate support and a gas distributer capable of introducing process gas into the process chamber (column 2, lines 64-68; column 8, lines 40-45). Additionally, Randall S. Mundt teaches a gas activator (column 2, lines 64-68; column 8, lines 40-45). Randall S. Mundt also teaches a reagent gas mixer capable of mixing a reagent gas with the effluent (column 3, lines 3-18).

Randall S. Mundt also describes an exhaust tube (18) through which the effluent may be flowed. The exhaust tube having an internal flow surface (82) substantially free of projections or recesses that alter the flow direction of the effluent through the exhaust tube.

Randall S. Mundt also describes a distributer plate (74 Fig.3) having holes (column 8, lines 1-11) adapted to direct effluent preferably along the internal flow surface of the exhaust tube.

Randall S. Mundt also describes a microwave energy applicator (column 3, line 49 - column 4, line 11) to couple microwaves to the effluent flow through the exhaust tube to reduce the hazardous gas content of the effluent (column 2, lines 64-68; column 8, lines 40-45).

Randall S. Mundt also teaches an exhaust tube with a length sufficiently long to reduce the hazardous gas content of a continuous stream of effluent flowing through the exhaust tube without recirculating the effluent (column 6, lines 23-27).

However, Randall S. Mundt does not teach an exhaust tube that is adapted to provide "a non-circuitous and non-turbulent flow of effluent therethrough" and this exhaust tube being substantially absent of projections or recesses "that cause turbulence in the flow of the effluent through the exhaust tube".

Uhm teaches microwave flue gas treatment as substantially claimed (column 2, lines 3-14). Additionally, Uhm teaches an exhaust tube (22, Figure 2) that is adapted to provide "a non-circuitous and non-turbulent flow of effluent therethrough" (column 2, lines 15-31). Uhm is silent with respect to the exhaust tube being substantially absent of projections or recesses "that cause turbulence in the flow of the effluent through the exhaust tube".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the Uhm exhaust tube adapted to provide "a non-circuitous flow of effluent therethrough".

Motivation for implementing the Uhm exhaust tube adapted to provide "a non-circuitous flow of effluent therethrough" in place of the Randall S. Mundt exhaust tube (18) is drawn to the benefits of the Uhm apparatus over that of the prior art including better uniformity of operation, better control, improved energy efficiency, and more compactness and simplicity (column 1, lines 20-30).

3. Claims 3, 8, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356) as applied to claims 1, 2, 6, 9, and 31 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt does not make specific reference to a residence time in the processing reactor of the gas to be treated. Additionally, Randall S. Mundt does not make specific reference to an RF energy applicator coupling RF energy to the exhaust tube.

Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to remove vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68,

column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6).

Chiu's exhaust system apparatus also make use of an RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63).

According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu[1].

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and, thus, as was demonstrated in the Examiner's calculations sheet (provided as an attachment to the first Office Action) provide residence time of the effluent flowing through the exhaust tube that is at least about 0.01 seconds.

Motivation for altering the geometry of the Randall S. Mundt effluent gas reactor according to the Kin-Chung Chiu design parameters is for allowing sufficient time for the contaminants to react (column 3, lines 24-45).

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[1]Refer to the Examiner's calculation sheet.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to add the Chiu RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63) to the Randall S. Mundt effluent treatment device as motivated by Chiu's removal efficiencies (column 9, lines 14-28).

4. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356), as applied to claims 1, 2, 6, 9, and 31 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt does not make specific reference to the flow regime (turbulent or laminar) in the processing reactor of the gas to be treated.

Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). Although Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry

as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and thus provide for laminar flow in the processing tube. Motivation is provided by Randall S. Mundt's discussion of flow rate ratio to electrode area (column 3, lines 30-45).

Allowable Subject Matter

5. Claims 7, and 37-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. Claims 10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78 are allowed.

7. The following is a statement of reasons for the indication of allowable subject matter: Independent claims 10, 11, 26, and 28 are allowed because none of the cited references provide the claimed conditions of operation of the microwave energy applicator coupling microwaves to the effluent and thereby energizing the exhaust gases in the exhaust tube as provided by the computer controller.

Independent claim 24 is allowed because the amended claim distinguishes from the closest related art, by Randall S. Mundt (U.S.Pat. 5,137,701), in the following point:

i. The exhaust tube (22, 24, 18, 30; Figure 1) through which the effluent may be flowed is *not* described as being fabricated from monocrystalline sapphire

Response to Arguments

8. Applicant's arguments filed March 20, 2002 with respect to claims 1-6, 8, 9, 31, and 32 have been considered but are not persuasive.

9. With regards to Uhm's metal fragments (25, Figure 2) as teaching "a chamber having projections", it is understood from the Uhm patent that the metal fragments do not constitute the "exhaust tube" that must be "substantially absent projections or recesses". Uhm's exhaust tube (housing cavity 24, Figure 2) is, as shown, "substantially absent projections or recesses" and is not made up from the metal fragments that are optionally installed as per the Uhm discussion (column 3, lines 23-25). Further, Uhm readily establishes the "threshold field" power requirement of "P≈8kW" (column 3, lines 18-22) for dielectric breakdown in the absence of materials placed in the chamber.

Conclusion

10. **THIS ACTION IS MADE FINAL**. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

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